# Selecting policy mechanisms for biodiversity conservation on private land

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## Abstract
The objective of biodiversity conservation policies is to achieve the level of biodiversity conservation that meets the needs of society. Using a transaction costs approach, it has been possible to establish the core elements of a biodiversity policy portfolio. Legislation is a key component of this portfolio. Its objective is to protect the core values of society, in this case to preserve a threshold stock of biodiversity. Other elements of an optimal policy portfolio need to be determined on the basis of supply prices. The optimum mix of management agreements on private land, land purchase, voluntary schemes, etc. is best determined according to which achieves the greatest increase in biodiversity per dollar of expenditure. There appears to be little scope for the use of taxes, fixed price subsidies and tradeable permits for terrestrial biodiversity conservation because of non-standard benefits and poor property rights specification. If policies are designed to reveal the supply price of additional units of biodiversity, it is possible to add eco-labelling and offset schemes to the policy mix. These mechanisms can reduce the funding burden of government and create wealth in the economy. Finally, education and information leading to attitude change will always be an important component of the environmental policy portfolio.

**Keywords**
biodiversity conservation, land use, environmental policy

## Introduction
There are over one million hectares of native vegetation on private land in Victoria. Much of it is of high conservation significance, providing habitat for native plants and animals as well as generating other environmental services. Approximately 15% of Victoria's threatened vegetation types rely solely on private land for their survival, and an additional 35% of threatened vegetation types occur largely on private land (NRE 1997).

It is widely accepted that the economy under-invests in the supply of goods and services provided by biodiversity. Although Victoria has an extensive public reserve system, it has not had a comprehensive set of policies that encourage conservation of biodiversity on private land. This paper briefly summarises the key features of policy mechanisms available and then examines how these measures interact, with a view to identifying a portfolio of mechanisms for biodiversity conservation on private land.

## Biodiversity conservation mechanisms
There are a number of policy mechanisms that can be used to increase investment in biodiversity conservation on private land. The key features of five classes of policy mechanisms: land purchase, legislation, voluntarism, market-based approaches and education are briefly reviewed in the following sections.

### *Land purchase*
Governments are suppliers of biodiversity through the public reserve system, and they have the option of increasing the supply by purchasing and managing private land. Whether land purchase is cost-effective depends on a range of factors, including its proximity to existing areas of Crown land, its purchase price, and the biodiversity gains that would be obtained. For

example, large areas of land adjoining an existing reserve may have low ongoing management costs, as these areas would more effectively utilise existing management resources, but may offer habitat that is relatively well represented in the existing reserve system. Alternatively, governments could consider purchasing small, isolated areas of habitat distant from existing reserves. These assets might involve high management costs, and incorporating them into the publicly administered reserve system would not take advantage of local knowledge, expertise and resources.

Generally, it has not been feasible to include remnant vegetation on private land in the national reserve system, although Colman (1991) strongly advocated land purchase to UK policy-makers. This is mainly because land purchased in the UK can subsequently be rented out, with restrictions on the agricultural practices allowed, so the government can earn rental income and farmers can still earn profits from agriculture (although profits would be lower than if agricultural practices were unrestricted). Colman also advocated that government reduces budgetary costs by co-purchasing land with private conservation groups that are willing to bear some of the subsequent costs.

### *Regulation*

Regulation has been commonly used by governments to halt the depletion of environmental assets such as river habitat, coast habitat and remnant vegetation. The type of regulation used has varied across and within countries. Usually regulation prevents some action, such as clearing vegetation, from being undertaken. At times it has included the compulsory acquisition of land deemed to be of high conservation value, such as in the USA (Stroup 1997, Innes et al. 1998, Polasky and Doremus 1998). Most developed economies impose regulations on the use and management of the environment. These regulations can be independent of other policy mechanisms, such as controls of clearing of native vegetation, or support other policy mechanisms, such as the legal specification of rights associated with tradeable pollution permits.

Regulations are generally advocated if an environmental asset is so near its environmental threshold that further degradation would cause an irreversible change in the environment. Weitzman (1974) argued that the use of regulatory controls (which he called ‘quantity’ instruments) are preferred when large changes in our standard of living are possible, such as when a known environmental thresholds exist. Young et al. (1996) supported the use of regulation as a ‘last line of defence’ in a government’s policy toolkit. However, they stress that regulation is a tool that must be used in conjunction with other mechanisms. Regulations that prohibit the use of toxic chemicals and radioactive materials are examples of regulations designed to avoid irreversible or costly outcomes. Under these circumstances it is not worth taking a risk with non-compulsory mechanisms that do not guarantee a given outcome, even if the incentives offered were very large.

Regulations are also an important component of other mechanisms employed in the economy. Even free markets are supported by regulatory frameworks that prevent unwanted outcomes, such as price-setting by collusion or monopolistic behaviour. Similarly, the use of market-like mechanisms for environmental management will rely on regulations to define property rights, facilitate the modification of property rights and specify the rules within which markets will operate.

### *Voluntarism*

Voluntarism is an important element of the biodiversity conservation portfolio. Organisations such as Ducks Unlimited, Nature Conservancy, The Royal Society for the Protection of Birds, and the World Wide Fund for Nature Conservation perform important conservation and advocacy roles. Voluntary actions, either independently or through conservation organisations, can take the form of *informal non-binding agreements* (e.g. choosing not to use environmentally damaging modes of transport), *formal non-binding programs* (e.g,. Land for Wildlife), or *formal binding programs* (e.g. Trust for Nature). Voluntary schemes are often a cost-effective form of conservation because they harness the private values of individuals who are conservation-

minded. One of the most important advantages of voluntary schemes is that the people involved have an interest in making a difference and are likely to be diligent in completing tasks that they believe will promote environmental conservation. One possible problem, however, is that there can be a difference between the objectives of volunteers and the overall conservation objective. This can arise because of the informal nature of the contract between the volunteer and the conservation organisation. There are two possible solutions to this problem. The first is to develop more formal contracts, such as the Trust for Nature covenants, where the obligations of volunteers are explicitly stated. A second approach is to invest in education and information for volunteers so that their actions align more closely with conservation objectives.

### *Market-based approaches*

Modern, open economies rely on markets to allocate goods and services between alternative uses. Over the past century economists have developed a detailed understanding of how markets provide the infrastructure for value to be created through mutually beneficial transactions. For many goods and services, however, markets do not work efficiently or are missing. The reasons why markets fail to become established or to operate efficiently have also been the subject of debate by economists. Coase (1937) identified 'transaction cost' as the main obstacle to the existence of markets. Today this vague concept is better understood, and it is known that information problems explain why markets do not take hold. Akerlof (1970) first demonstrated this problem with respect to the market for 'lemons'. He showed that even in regular markets, such as second-hand motor cars (hence lemons), an uninformed party (the buyer) is liable to be exploited, and may be unwilling to participate in the market. Because of this, the potential benefits of doing business (which may be very large across the whole economy) may not be realised. This is called the asymmetric, or hidden, information problem. Asymmetric information means that it is hazardous to do business with someone who has relevant but hidden information.

The realisation that many environmental problems suffer from asymmetric information has significantly improved our understanding of the environment as an economic problem (see Bardsley et al. 2002). It can be seen, for example, that landholders and governments might be unwilling to develop contracts to conserve remnant vegetation because each party has private information that will influence the contract. Landholders, for example, have private information about the cost of undertaking certain actions, and governments have private information about the impact of these actions on biodiversity. Under these conditions, markets are unlikely to emerge because of the risks in developing contracts in the presence of hidden information. This perspective also raises the prospect of creating policy mechanisms that perform the function of markets (i.e. to allocate resources) by directly addressing the information problems noted above. There are five market-based mechanisms that can be contemplated for environmental management: taxes and subsidies, tradeable property rights, auctions, eco-labelling, and offsets.

#### Taxes and subsidies

Taxes are per-unit payments levied on undesirable activities, and subsidies can be thought of as payments for desirable activities.[1] Taxes aim to discourage unwanted behaviour (e.g. harmful emissions) by introducing the marginal social cost[2] of various actions into the decision-making process. For example, the introduction of a tax on emissions equal to the marginal damage cost of these emissions should limit emissions to the socially optimum level.

There are many limitations to the use of taxes and subsidies with respect to biodiversity conservation. Where there are non-standard benefits (that is, the service provided differs form site to site, as is the case with biodiversity), taxes and subsidies would only be efficient if a different tax rate were set for each site. It is also difficult to structure a set of taxes that takes account of multiple outcomes arising from one action. Finally, a tax does not place a limit on the total amount of environmental damage: as more firms enter a polluting industry, tax revenue

[1] Taxes and subsidies are discussed jointly even though they have different effects.
[2] Marginal social cost includes all costs associated with a particular action, not just those evident to the decision-maker.

will rise but so will pollution. This is particularly important when the input causing the environmental problem is not responsive to price changes, and where a threshold exists. Taxes are best suited to problems where there are standard benefits associated with abatement; for example, where there is uniform mixing of pollutants such as greenhouse gas emissions.

## Tradeable property rights

Under certain circumstances markets can be created by changing property rights and defining trading rules. In markets for tradeable emissions permits, for example, individuals are assigned rights to pollute (within a cap on total pollution), allowing markets to determine the distribution of these rights between firms. The important point about tradeable emissions rights is that individual firms determine the level of pollution and abatement that maximises profit. Individual firms, not government, make the decision to reduce environmental damage based on the marginal cost of abatement. Some firms will make no change, while others will be able to reduce environmental damage in very cost-effective ways and gain by selling pollution credits. These different responses by different firms simply reflect the fact that there is considerable variation in the cost of abatement between firms. Tradeable emission markets are designed to allow the economy to discover these differences in abatement costs and take advantage of low-cost abatement actions.

This approach has proven to be a very effective and low-cost way of achieving a specified emission target, but is limited to those situations where property rights can be tightly specified, such as point source emissions. There are many examples of tradeable emission schemes in operation where property rights can be well defined, such as with point-source pollution.

## Auctions

Auctioning conservation contracts is another important market-like mechanism that has recently been applied to conserve biodiversity on private land, but which has general application to a broader set of environmental problems (see Latacz-Lohmann and Van der Hamsvoort 1997). Auctions are of interest because they can be employed to deal with asymmetric information problems, as noted earlier. Well-designed auctions harness competition between landholders so that they reveal information about the cost of changing land-use that will provide benefits to biodiversity conservation; this information is not known by government. Auctions can also be designed to allow the government to reveal information about the importance of different environmental assets; landholders will not necessarily know this information.

The recent trial of an auction-based approach to biodiversity conservation on private land (called BushTender) showed that this approach is cost-effective and readily engages landholders (see Stoneham et al. 2002). The ability to write efficient contracts for biodiversity conservation was made possible because the auction revealed information needed for government to become an ‘intelligent purchaser’ and landholders become ‘competitive suppliers’ of biodiversity goods and services. By improving the methods used to assess the relative importance (from a biodiversity perspective) of each plot of habitat on offer, the purchaser (the government in this case) has information that improves the selection and specification of contracts. Similarly, the introduction of competition between landholders to supply additional biodiversity services facilitates cost-effective outcomes from the auction process. The pilot BushTender auction showed that there are large differences in the opportunity cost of landholders, allowing governments to take advantage of low-cost, high-biodiversity-gain offers. Attention to information problems in the design of the BushTender auction allowed meaningful contracts to be written and enabled the creation of policy mechanisms that act like markets to allocate resources to biodiversity conservation.

## Eco-labelling

Labelling is a means of revealing information from both producers and consumers. Labels allow consumers to express their willingness to pay for goods that have been produced under biodiversity-friendly systems. Labels also allow producers to reveal characteristics of the goods that are not evident from taste, smell or sight. For example, labels are sometimes used to reveal

that a particular company has invested in conservation actions, and some consumers are willing to pay a premium for such a credence attribute.[3] Revealing this information can, therefore, raise investment by private firms in biodiversity conservation according to consumers' preferences.

There are two key problems with this approach. If there is too great a difference between the information on the label and the real goals of biodiversity conservation, eco-labelling will encourage ineffective investment. The second problem is the compliance of firms with the claims made on label.

Offsets

Offset schemes allow firms or organisations whose actions cause degradation of the environment to fund an equivalent replacement of services. Mitigation banking schemes have been developed in the USA (e.g. The Wetlands Mitigation Banking Scheme) to allow offsets to development. In Australia, the EPA (NSW) have recently announced a Green Offsets scheme which if applied could allow environmental damage caused by development activities to be offset by abatement actions. These offset schemes offer the prospect of efficiency gains in the economy where the marginal value of development exceeds the marginal cost of habitat replacement. The main problem with offset schemes is whether it is possible to ensure that recreated or augmented habitat fully offsets the damage caused to the environment by development.

*Education and information*

Tietenberg and Wheeler (1998) have argued that investment in the provision of information constitutes the third wave of environmental management.[4] Education and information change attitudes toward the environment leading to changes in behaviour. Portney (2000) contends that disclosure of information about environmental impacts can also have a self-regulating effect. This occurs because firms required to disclose their levels of emissions are inclined to self-regulate their emission levels even when the levels of emissions are legal. Heightened understanding of environmental issues by society in general and improved expertise and specialised knowledge among scientists and economists are also important requirements for better conservation outcomes.

## A portfolio of policy mechanisms

No single policy mechanism can deal with environmental problems that display complex attributes. Biodiversity conservation on private land is beset by problems of incomplete information, including asymmetric information, poorly defined property rights, non-standard benefits, multiple benefits and non-market values. This suggests that a mix of policy mechanisms will be needed to adequately deal with biodiversity conservation.

Defining an efficient set of policy instruments that might be applied to biodiversity conservation on private land involves a consideration of the different characteristics of each instrument available (summarised in the previous section) and an analysis of transaction costs associated with adjusting elements of the policy portfolio. This approach involves examining the 'comparative costs of planning, adapting and monitoring task completion' (see Williamson 1989) that would be required if different policy mechanisms were used to achieve a given biodiversity conservation goal.

Consider, for example, the impact of increasing the role of legislation in order to achieve a net gain in biodiversity conservation on private land. Extending legislation beyond the role of protecting essential biodiversity stocks, as noted earlier, would increase policing and monitoring costs and make the legislation more complex. Policing and monitoring costs would increase because the excessive use of legislation would become onerous and unpopular. The inability of legislation to identify specific actions needed on different areas of land and its inability to

[3] Credence goods are those where the quality attributes are not discerned through the senses such as taste, touch, smell. Milk produced from a farm that does not harm the environment is an example of a credence attribute.
[4] The first wave was Command and Control and the second was market-based approaches.

discover the opportunity cost of abatement action raises the cost of employing legislation for biodiversity conservation. Alternatively, there would be significant costs involved in designing and implementing legislation that could accommodate non-standard benefits and heterogeneous opportunity costs.

Legislation will form the foundation of a policy portfolio for biodiversity conservation on private land. It is appropriate to use legislation to maintain a critical mass of biodiversity through the control of actions or inputs (e.g. limits on clearing) which are non-specific, readily observable and enforceable. Attempts to employ legislative approaches beyond this point will raise transaction costs per unit of biodiversity conservation. As noted above, legislation set above the values of society will incur large monitoring and policing costs associated with poor compliance, and legislation that is too weak will increase the cost of other policy mechanisms that would be required to meet specific biodiversity conservation goals.

Mechanisms other than legislation will be needed if gains in biodiversity conservation are to be cost-effective. For other goods and services in the economy, prices assist decision-makers to identify optimal combinations of inputs or outputs that achieve their goals. Unfortunately information about supply prices (the cost of an additional unit of biodiversity) and willingness to pay (demand-side prices) are not automatically available to environmental policy-makers. We noted earlier that environmental markets are missing or severely limited. However, the use of market-based instruments does raise the prospect of revealing supply prices where markets can be created. Mechanisms that reveal information about prices are of particular interest to policy makers because these allow resources to be allocated on the basis of "value for money". It is now known, for example, that it is possible to generate a supply curve for biodiversity using auctions (see Stoneham et al. 2002). This information on supply prices was made possible because of two important developments:

- Ecologists were able to constructing a metric to express biodiversity preferences. This was made up of a scarcity element (the Biodiversity Significance Score (BSS) in BushTender) and a Habitat Services Score (HSS).
- Economists were able to design a mechanism that revealed the opportunity cost of changing land use for biodiversity conservation (the bids provided by landholders).

Using this approach, each proposal for conservation actions submitted by landholders was assessed on the basis of the expected biodiversity outputs (BSS x HSS) per dollar of additional investment (see Stoneham 2002).

Other policy mechanisms could be designed to reveal similar information about the supply price of additional units of biodiversity. Land purchase and voluntary actions could both be designed in this way if the relevant biodiversity metric were applied to each proposed land purchase/voluntary option. Land purchase would be included in a policy portfolio if that approach offered better value for money than bids in an auction for biodiversity conservation contracts on private land. By comparing biodiversity supply prices for different land purchase, voluntary proposals, bids on management agreements on private land, and so on, it would be possible to identify which ones represent the best value for money. Designing policy elements so that they reveal the cost of additional units of biodiversity (supply price) may, therefore, be a useful way of determining the relative importance of different elements in the policy portfolio. In this way, the portfolio of mechanisms is selected on the basis of which action achieves the greatest gain in biodiversity for each dollar expended. Addressing the portfolio selection process on this basis also raises the possibility of including new mechanisms — specifically, eco-labelling and offsets.

Eco-labelling suffers the same alignment problems that were discussed with non-binding voluntary schemes: despite good intensions, there is no way for the public to discriminate between alternative companies that both claim large investments in biodiversity conservation. Whether the conservation actions promoted by company A generate more habitat services than the company B is difficult to discern without further information. One approach to this problem could be to employ a standard way of measuring biodiversity improvement, as far as is technically feasible. As noted earlier, the metric used to measure improvements in biodiversity

for BushTender were the habitat services score and biodiversity significance score. A standard metric would allow consumers to assess the relative merits of different private actions and allow private firms to differentiate their products accordingly. This would allow private firms to efficiently source green credentials (they could be purchased from an auction, land purchase, on-farm investments, etc.), and would also provide a means of reducing the call on public resources to fund biodiversity conservation.

Similarly an offset scheme that allowed firms that cause degradation of biodiversity to purchase an equivalent amount and quality of biodiversity improvement will improve economic efficiency in the economy. These efficiency gains arise because added flexibility has been introduced into the economy so that the constraints on development are less binding. Of course, this outcome depends on whether units of biodiversity are able to be adequately defined and offset — a largely unproven proposition at this point.

## Conclusions

Biodiversity conservation is a complex policy problem. The objective of policies is to achieve the level of biodiversity conservation that meets the needs of society but at least cost to society. Using a transaction costs approach, it has been possible to examine the role of different elements of a biodiversity policy portfolio. Legislation is a key component of this portfolio. Its objective is to protect the core values of society — in this case to preserve a threshold stock of biodiversity. Transaction costs, such as policing, monitoring, and design, would increase markedly if legislation were used to achieve gains in biodiversity beyond this threshold point. Other elements of an optimal policy portfolio need to be determined on the basis of which actions (management agreements, land purchase, voluntary schemes, etc.) achieve the greatest increase in biodiversity per dollar of expenditure. Designing policy mechanisms that reveal the cost of additional units of biodiversity (supply prices) is one approach that could be used to identify the importance of the alternative mechanisms. Using this approach, the problem resolves to one of selecting the most cost-effective elements, rather than a comparison of the features of different policy mechanisms.

For biodiversity conservation on private land, there appears to be little scope for the use of taxes, fixed price subsidies and tradeable permits because these mechanisms do not efficiently discover supply prices where there are non-standard benefits and poorly defined property rights.

If policies are designed to reveal the price of increasing biodiversity supply, it may be possible to add eco-labelling and offset schemes to the policy mix, provided there is sufficient confidence in the fungibility of the units of biodiversity defined. These mechanisms have three beneficial features:

- they allow private firms to fund biodiversity conservation activities where there are commercial gains from doing so
- they create value in the economy by facilitating the exchange of information between consumers and producers (eco-labelling) and by introducing more flexibility in meeting constraints (offset schemes)
- they offset the demand for public funds needed for biodiversity conservation.

Finally, education and information leading to attitude change will always be an important component of the environmental policy portfolio.

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